Alaska Coral and Sponge Initiative

2020-2024

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AFSC Team Coral

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Steering Committee: Alexis Weinnig (DSCRTP), Heather Coleman (DSCRTP), Bryan Costa (NCCOS), Chris Rooper (DFO Canada), Seanbob Kelly (AK Region), Cal Mordy (PMEL), John Olson (ACE)

Past members: Tom Hourigan (DSCRTP), Meredith Everett (NWFSC), Carol Ladd (PMEL), Sam Candio (OER), Amanda Netburn (OER), Jennifer Le (OER), Caitlin Adams (OER), Linda Shaw (AK Region)

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Alaska Coral and Sponge Initiative (AKCSI)

- Funded through the Deep Sea Coral Research and Technology Program
    - Established under the Magnuson-Stevens Fishery Conservation & Management Act in 2006 (MSA SEC. 408a)
    - The program is focused on increasing knowledge about deep-sea coral ecosystems and supporting resource managers to both inform conservation activities and manage threats to deep-sea coral and sponge habitats.
    - Activities guided by the NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems

- National DSCRTP implementation provides funds through rotating regional initiatives.
    - Alaska Coral and Sponge Initiative: 2020 - 2024
    - Total funding $3.4 M
    - Final report: https://repository.library.noaa.gov/view/noaa/71207

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2020-2024 DSCRTP Alaska Initiative

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AKCSI Science Plan Research Priorities

1. Validation of Gulf of Alaska coral and sponge distribution models using visual surveys that collect environmental and spatially-explicit biological data.
2. Mapping of untrawlable habitats in the Gulf of Alaska and Aleutian Islands.
3. Collection of life history information on corals and sponges to support population modeling.
4. Use of eDNA for species distribution modelling and biodiversity studies, and other genetic techniques for taxonomy and connectivity modelling.
5. Development of risk assessment models for corals and sponges in the GOA, AI, and EBS that take into account anthropogenic and climate effects.
6. Investigation of recovery and susceptibility rates of corals and sponges to anthropogenic activities.

Field Expeditions

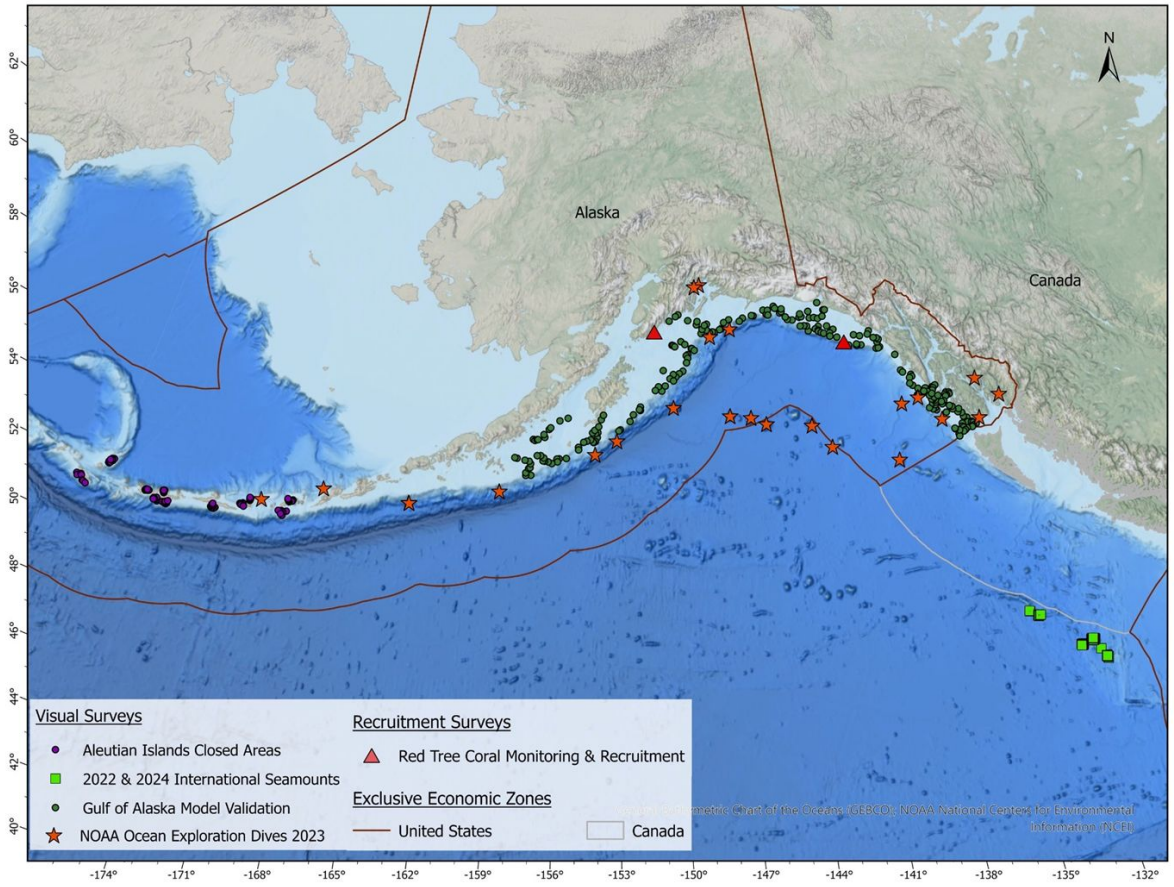
Research Expeditions

1. Validation of Coral and Sponge Distribution Modeling in the Gulf of Alaska (Malecha, Rooper, Goddard)

2. Recruitment, Reproduction, and Larval Supply of Alaska Deep-Water Corals (Hoff, Waller)

3. Joint Canada-USA Seamount Exploration in the Eastern North Pacific Ocean (Rooper, Conrath, Goddard)

4. Assessing the Effectiveness of Area Closures for Maintaining Healthy Deep-Sea Coral and Sponge Communities (Conrath, Goddard, Olson)



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Research Projects

1. Sponge Identification and Genetics in the Gulf of Alaska and Aleutian Islands (Rooney)
2. Observations of Longline and Pot Gear Interactions with Corals and Sponges (Malecha)
3. Genetic and eDNA Work to Support Studies in Taxonomy, Species Identification, and Distribution, and Connectivity in Deep-Sea Corals and Sponges (Everett)
4. Environmental DNA Collections for Identifying Fish Associations with Coral and Sponge (Larson)
5. Risk Assessment of the Impacts of Commercial Fishing on Corals and Sponges in Alaska (Olson)
6. The Influence of Deep-Sea Coral and Sponge Ecosystems on the Life History of FMP Species in Alaska (Conrath)

AKCSI Science Plan Research Priorities

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Objective 2: Mapping of untrawlable habitats in the Gulf of Alaska and Aleutian Islands

What was done?

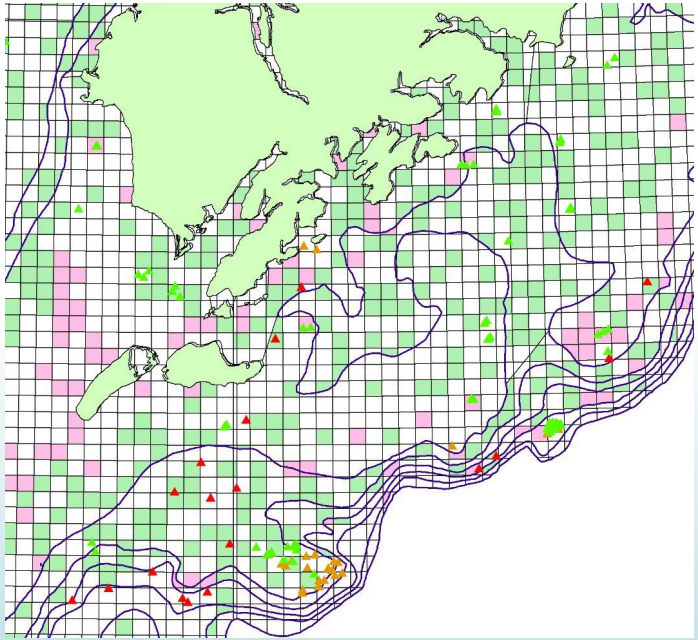
- Additional data obtained from 465 drop camera transects:
  - Field expedition #1: GOA model validation
  - Field expedition#4: Area Closures in Aleutian Islands
  - Field expedition#3: JCUISS surveys, Cobb Seamounts

What data are available?

- Visual observations contributed to the development of an Alaska wide visual data set.
- Sigler et al. (in review): developed a new spatial prediction layer for rock/cobble.
- Data from other sources that is available: Bryan et al. 2023.

What are the next steps?

- Re-examination of fish and invertebrate abundance in trawlable and untrawlable habitat using Alaska visual data set.



Objective 3: Collection of life history information on corals and sponges to support population modeling

What was done?

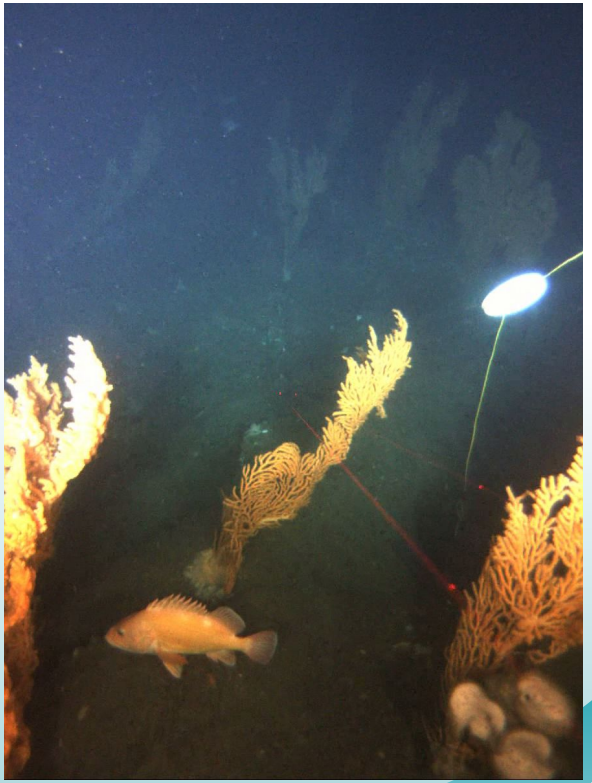
- Field expedition #2: 4 recruitment plates retrieved, 9 deployed
- 15 sprigs of red tree coral collected and transported to Auke Bay Laboratories
- Research project #1: sponge samples collected to study taxonomy during AFSC bottom trawl surveys

What data are available?

- New reproductive information: observations of live sperm, polyp bailout
- 9 new species of sponges in Alaska, range extensions

What are the next steps?

- 6 ARMS plates are deployed at Fairweather Grounds and Pye Islands.
- Continue to research the biology and ecology of deep-water coral and sponge species.



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Objective 4: Use of eDNA for species distribution modelling and biodiversity studies, and other genetic techniques for taxonomy and connectivity modelling.

What was done?

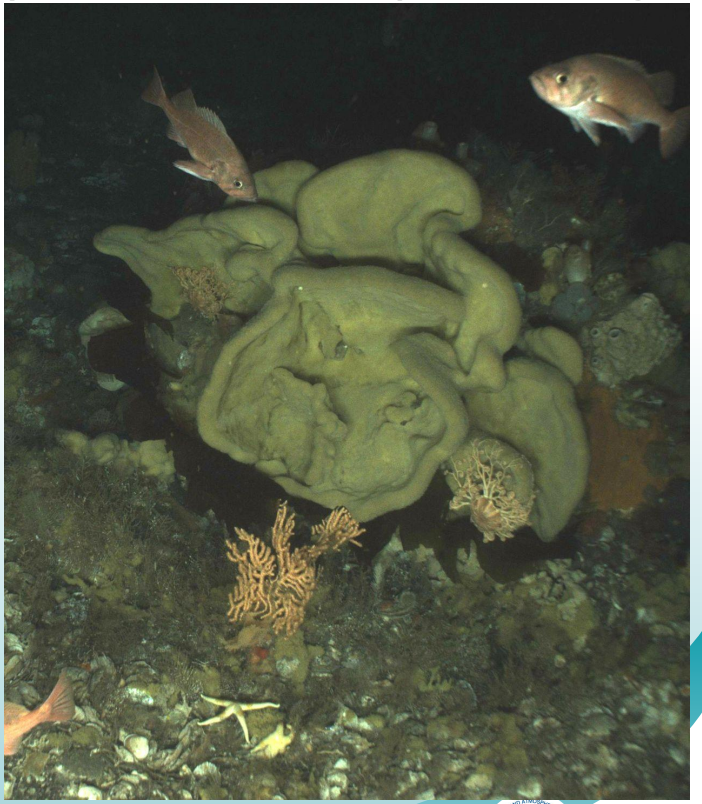
- Research projects #3, #4 focused on the analyses of of eDNA collected during three field expeditions.
  - 223 samples Gulf of Alaska
  - 96 samples Aleutian Islands
  - 115 samples Cobb-Seamount

What data are available?

- eDNA data will be available for most of the camera transects in the Gulf of Alaska, Aleutian Islands, and Cobb Seamounts

What are the next steps?

- Explore the use of these data for: contributions to presence/absence models of distribution, assistance of species identification from visual data, etc.



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Objective 5: Development of risk assessment models for corals and sponges in the GOA, AI, and EBS that take into account anthropogenic and climate effects.

What was done?

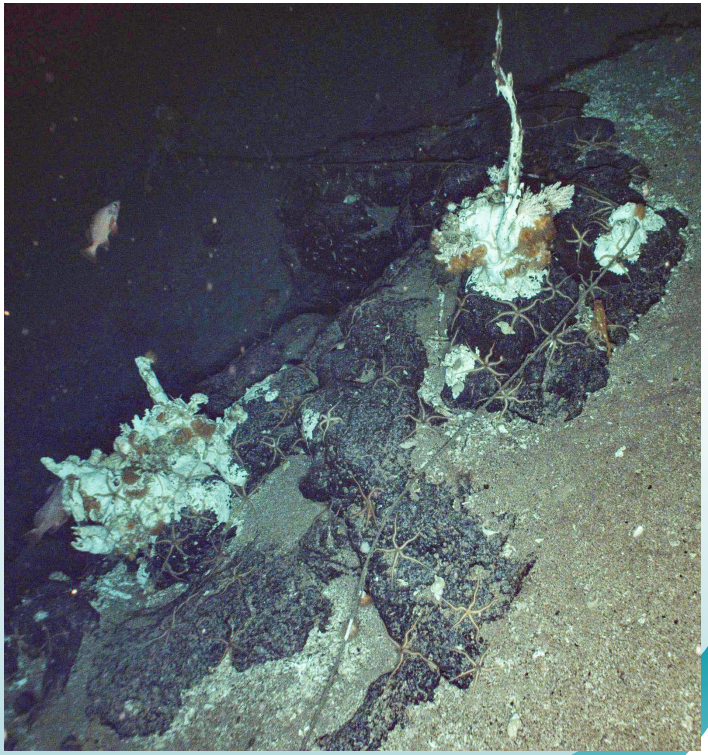
- Research project #5: Using the FE model framework, developed code to integrate susceptibility and recovery values for habitat features using literature studies (collaboration with John Olson, Scott Smeltz, APU)

What data are available?

- This model run resulted in updated VMS and S/R data and coral/sponge covariates, describing "habitat reduction" as a percentage reduction from the unfished state, provided habitat feature-specific Fishing Effects model runs, and provided an assessment of fishing impacts to corals and sponges.

What are the next step

- Continue to examine the risk of fishing and oceanographic changes to structure forming invertebrates.



Objective 6: Investigation of recovery and susceptibility rates of corals and sponges to anthropogenic activities.

What was done?

- Field initiative #4: Assessing the Effectiveness of Area Closures, 102 stereo camera transects throughout the Aleutian Islands completed in 2023
- Research project #5

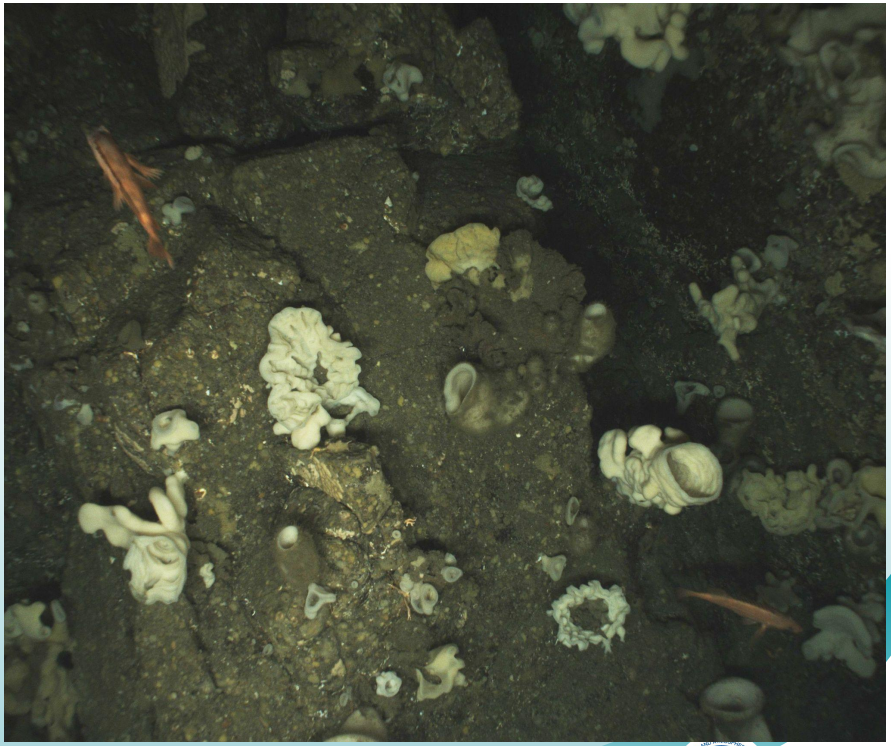
What data are available?

- Analyses are on-going for Field Initiative #4 and data are not yet available.
- APU led projects: updated FE models with new spatial coverages for sponges, corals, and pens, use of drop camera transects in combination with fishing history to examine recovery rates.

What are the next steps?

- Annotation and continued data analyses and exploration

Objective 1: Validation of Gulf of Alaska coral and sponge distribution models using visual surveys that collect environmental and spatially-explicit biological data.



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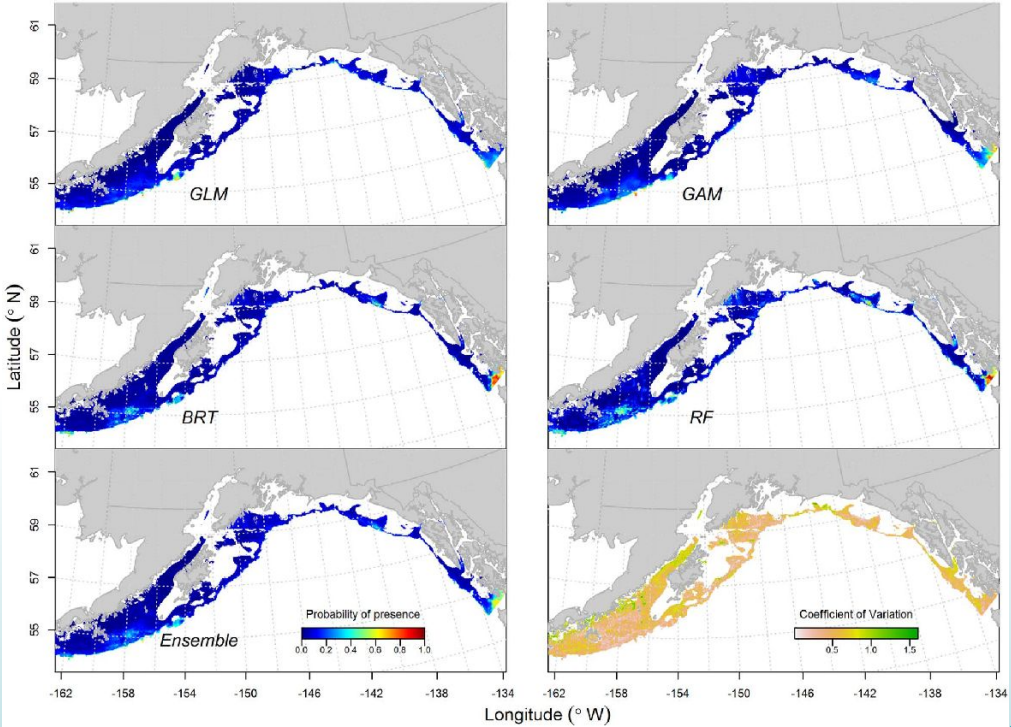
First Alaska Initiative (2012-2015)

- The probabilities of coral and sponge presence and abundance in the Aleutian Islands, Bering Sea, and Gulf of Alaska were predicted using trawl survey data and environmental parameters (Rooper et al. 2017).
- Camera observations were collected in the Bering Sea slope and canyons (Rooper et al. 2016) and throughout the Aleutian Islands (Rooper et al. 2018) to validate these models.
- Gulf of Alaska models needed validation with *in situ* camera data



Coral Presence

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GOA Model Validation Objectives

- Validate existing models of coral and sponge presence and abundance with *in situ* camera observations
- Improve next iteration of coral and sponge model outputs
- Document species associations between coral, sponge and managed species
- Compare visual and eDNA observations

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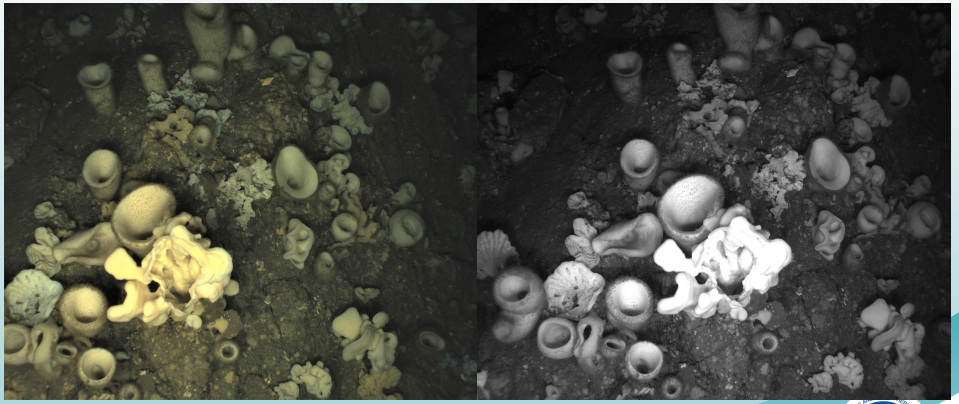
GOA Model Validation - Survey Camera Ops

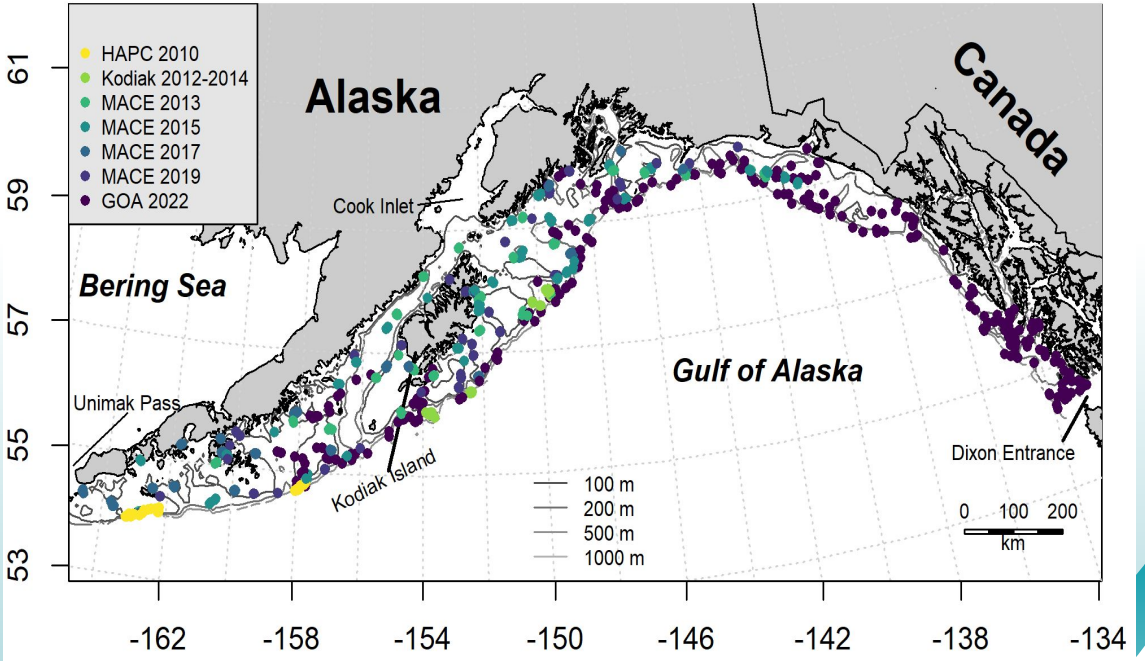
- 228 camera transects
- Depths 18-879 m
- Stereo camera drifted ~15 minutes
- Image annotation in *Sebastes*
  - Substrate identified
  - Identification of corals and sponges
  - Identification of fishes
  - Height measurements (corals) and length measurements (fish)



GOA Model Validation **2010-2022** Camera Data

712 total camera transects

- Nine research cruises
- Four studies
  - HAPC mapping of coral and sponge (2010)
  - Rockfish habitat use (2012, 2013, 2014)
  - MACE midwater and benthic fish surveys in trawlable and untrawlable habitat (2013, 2015, 2017, 2019)
  - GOA Validation (2022)



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GOA Model Validation 2010-2022

Bottom Trawl Survey Distribution Models

Two types of models:

- Presence/Absence
- Abundance (CPUE)

Six taxa:

- Primnoidae
- Pennatulacea
- Coral (minus scleractinians and pennatulaceans)
- Demospongiae
- Hexactinellida
- Porifera

Rooper, C.N., K. Williams, R.Towler, P.W. Malecha, P.Goddard, D.T. Jones, and M. Sigler. 2025. Lessons learned from testing the predictions of species distribution models for deep-sea corals and sponges in the Gulf of Alaska with comparisons to other Alaska ecosystems. *ICES Journal of Marine Science*, Volume 82, Issue 10, October 2025, fsaf189, https://doi.org/10.1093/icesjms/fsaf189

GOA Model Validation – Trawl Based Model Performance

Presence/Absence Models:

- "Acceptable" for predicting Presence/Absence of Coral, Primnoidae, and Demospongiae
- Almost acceptable for Porifera
- Poor at predicting Hexactinellida and Pennatulacea
- Provide consistent results across Alaska regions by taxa
- Decent at predicting absence but not as good at predicting presence

Density Models:

- Performed poorly for most taxa groups.
- Correlations between model and camera observations were significant and positive
- But camera-based abundance variability not well predicted – only 15-20% explained by trawl-model
- Positive residuals for Pennatulacea, Porifera, Demospongiae, and Hexactinellida indicates consistent under predictions

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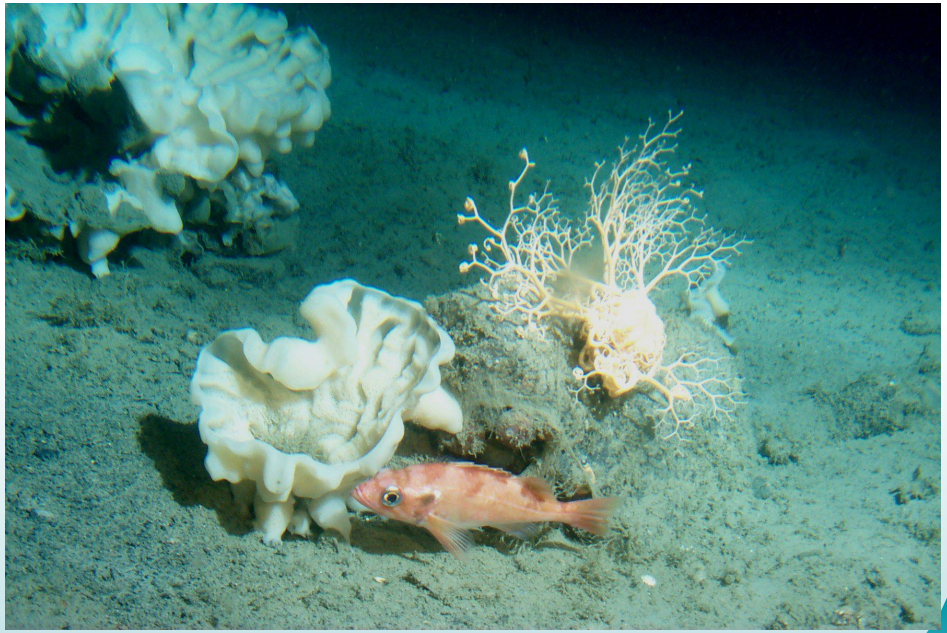
GOA Model Validation – Summary

- Trawl-Based Models:
  - Provide consistent results but are less informative for some taxa
  - Limited by low catchability of target taxa (key reason why presence and abundance are under-predicted)
  - May be improved by the incorporation of additional data sources, e.g. camera surveys, eDNA, substrate classification, environmental data
- Camera-based observations remain the "gold standard" for characterizing deep-sea communities



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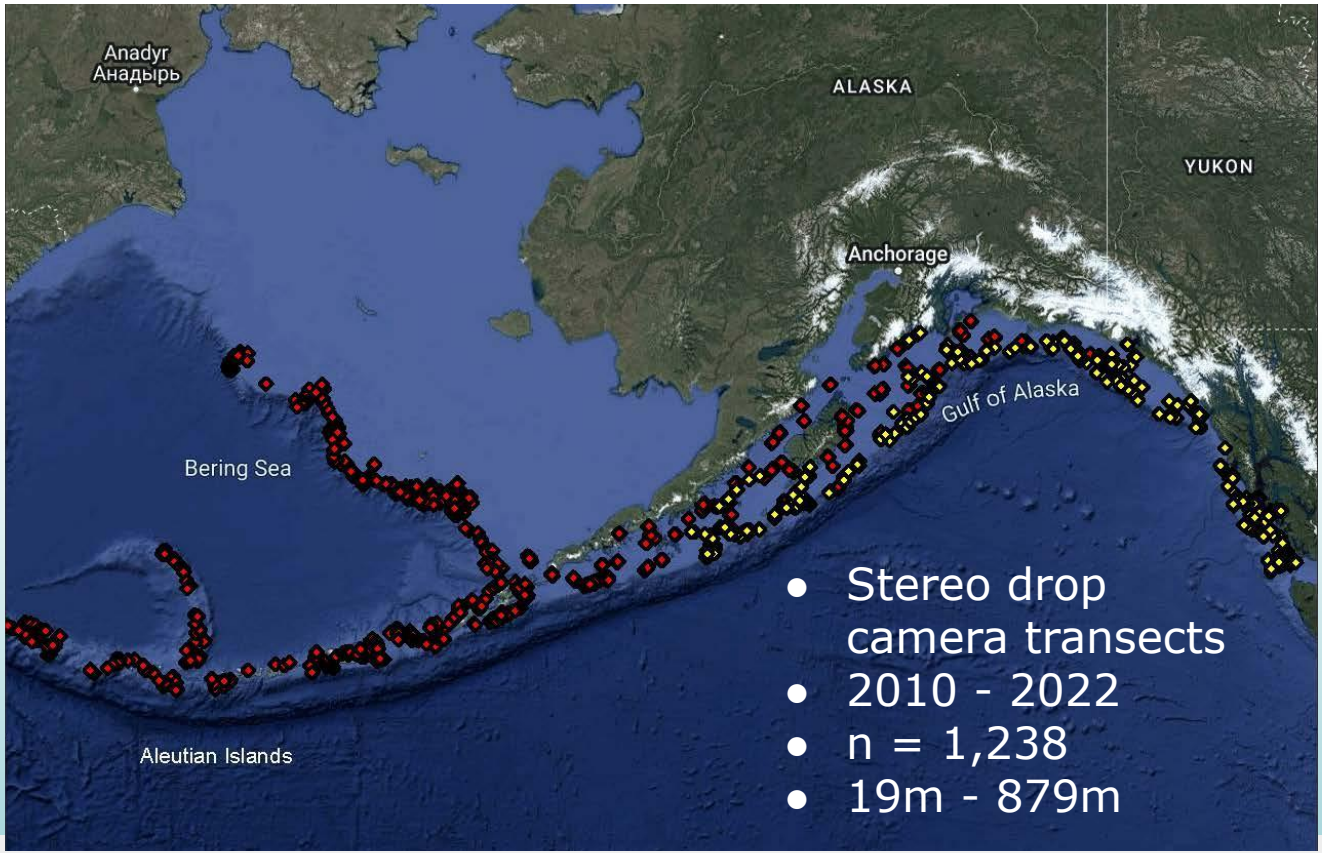
Visual Camera Observations



Data Sources Include:

- HAPC mapping of coral and sponge (2010)
- Rockfish habitat use study (2012-2014)
- MACE midwater and benthic surveys in trawlable and untrawlable habitat (2013, 2015, 2017, 2019)
- GOA Validation (2022)
- Aleutian Validation (2012, 2014)
- Bering Sea Canyons (2014)

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Alaska Visual Data Set

- Collaboration with the Alaska Region to incorporate these data into SFI covariates for the next EFH review.
- Sigler, M.F., C.N. Rooper, P.Goddard, R.Wilborn, and K. Williams. 2023 Alaska deep-sea coral and sponge assemblages are well-defined and mostly predictable from local environmental conditions. Mar Ecol Prog Ser 712:67-85 https://doi.org/10.3354/meps14317
- Sigler, M.F., C.N. Rooper, P.Goddard, R.Wilborn, P.W. Malecha, K.Williams, and C. Conrath. In Review. Ecology of deep-sea corals and sponges in subarctic Alaska.
  - New Alaska-wide species distribution models for coral and sponge using only camera data
  - Enhanced examination of environmental variables structuring coral and sponge
  - Evaluation of habitat quality based on density and height of coral and sponge
  - Map of habitat hotspots
- Re-examination of fish and invertebrate abundance in trawlable and untrawlable habitat.
- Other projects to support the proof of concept study for using underwater cameras during GOA and AI bottom trawl surveys.

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Steering Committee: Alexis Weinnig (DSCRTP), Heather Coleman (DSCRTP), Bryan Costa (NCCOS), Chris Rooper (DFO Canada), Seanbob Kelly (AK Region), Cal Mordy (PMEL), John Olson (ACE)
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Captain and the crew of the *R/V Woldstad*
Captain and crew of the *R/V Solstice*
Captain and crew of the *CCGS John P. Tully*
Captain and crew of the *CCGS Sir John Franklin*
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Thank you

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